

# Perverted Priorities

## The Physician/Scientist as Spokesman and Salesman for Biomedical Research

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Fellow members of the ASCI, members the AFCR and AAP, and guests. On behalf of myself and the officers and councilors of the ASCI, I want to thank you for having given us an opportunity to serve the Society. The ASCI represents the finest of young physician/scientists, and to have served the Society as president is indeed an honor. One of the foremost aspects of this honor is the opportunity to address you, the members of the Society, my colleagues and friends, about a topic that I feel is of prime importance to all of us; namely, what is the future of biomedical research, and what should our roles be in determining its future?

Biomedical research is truly in a golden era. The advent of molecular biology, sophisticated biochemical techniques, cell biology, and advanced methods to study whole body physiology and pathophysiology have allowed us to increase our understanding of disease at an unprecedented rate. One need only look at the six abstracts that were just presented, as well as the others presented throughout this meeting, to realize that over these few days there will be more diseases whose mechanisms will be elucidated at a molecular level than in any decade in the first half of this century. Novel approaches to diagnosis, therapy, and the prevention of disease are being offered at an unprecedented rate. Despite this boom of biotechnology, the physician/scientist, and in fact all scientists, find themselves under increasing pressure to justify their research, to document both the scientific and administrative aspects of the work, and to prioritize competing research projects and needs. If we are to move forward at the pace of which we are capable, we must take greater control of our destiny.

To achieve this goal, however, we must ask ourselves four important questions that will form the basis of our approach when seeking research support for the future. First, how much research is enough? Second, is biomedical research cost effective? Third, who should pay for biomedical research? And finally, what should we as physicians and scientists do to improve research funding? To answer these questions we must understand more about ourselves, our industry (and biomedical research is indeed an industry), the society in which we live, and its priorities.

Currently in the United States about 14 billion dollars are spent on biomedical research. Of this, about 7 billion dollars come from federal sources, about 6 billion from industry, and a little less than 1 billion from various types of nonprofit foundations and associations (1).

For us, the most important single source of funds is the National Institutes of Health (NIH). Over the past eight years the NIH has had an increase in budget from 3.2 to 6.2 billion dollars (2). These figures are often displayed as an example of the strong support given to biomedical research, even in times when there is considerable political pressure on federal budgets. But is this, in fact, a reasonable amount for biomedical research, and is the rate of growth appropriate?

One of the most frequent approaches used to determine the adequacy or inadequacy of federal support for medical research is a comparison of the NIH budget with that of the other major federal research program, defense-related research. Compared with defense research, the NIH budget is truly miniscule (Fig. 1). In fact, the increase in defense research during the past eight years, and just the increase, is more than threefold the entire NIH budget. Since the total budget for health care-related expenses is much greater than the total budget for all defense-related expenses, this difference is further magnified if one expresses research and development (R & D) as a percentage of total expenditures in each area.

In Fig. 2 I have summarized these figures along with data taken from *Business Week* on R & D expenditures for a number of different types of industries (3). In each case, R & D is expressed as a percentage of gross expenditures. While it is true that the defense industry tops the list with over 13% of expenditures for R & D, the pharmaceutical industry, leisure time activities, the aerospace industry, the electronics industry, and the automotive industry all have R & D expenditures of over 3.5%. This compares with the budget for health-related R & D over the last four years, which has averaged between 2.9 and 3.2%, barely edging out the amount of research done by the tire and rubber industry! Thus, compared with virtually any industrial standard, biomedical research is significantly underfunded.

If you are not yet convinced, let me remind you that the 13% for defense represents only the federally funded component, whereas the 3% figure for health includes not only all federally supported research, but all industry- and foundation-supported research. In addition, health R & D is calculated based only on direct medical expenses and does not take into account the true economic burden created by disease. If one considers medical R & D on this basis, the suboptimal level of funding becomes even more apparent.

For example, there are 20 million people in the United States with heart disease.<sup>1</sup> The economic burden of heart dis-

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1. The data in this and the following paragraphs were compiled using the NIH Data Book (1), and data published in the *Sacramento Bee*, special supplement on The Killing Diseases, 15 September-3 October 1985 (7), as well as figures kindly provided by the American Heart Association, The American Diabetes Association, The Juvenile Diabetes Foundation, and the Arthritis Foundation.

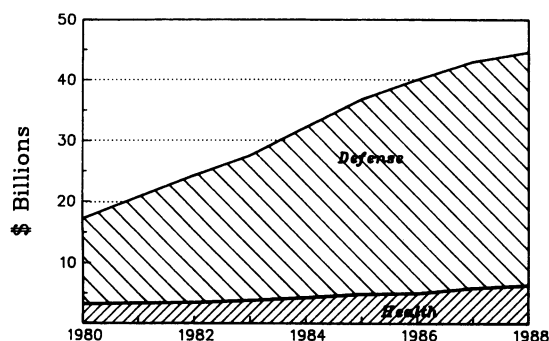


Figure 1. Federal spending for research and development. From data in reference 2.

ease, that is, the cost of medical care as well as the lost potential income, is about 5,000 dollars per person affected per year. The total budget for cardiovascular disease research at the NIH is about 500 million dollars. While this may seem like a lot to you or me, this amounts to only about 25 dollars per person affected per year, or less than 1% of the economic burden.

Similar figures can be derived for virtually all major diseases (Fig. 3). There are about 10 million people in the U.S. with diabetes. The economic cost of diabetes is about 1,400 dollars per person affected per year. The total budget for diabetes research is a little over 200 million dollars, or only 20 dollars per person per year, about 1.4% of the total economic burden.

There are about 37 million people in the U.S. with arthritis. While the economic cost of arthritis is only about 200 dollars per person per year, the total budget for arthritis research, about 150 million dollars, represents only 4 dollars per year per person affected. Thus, it should be clear that biomedical research is inadequately funded when compared with the economic burdens created by disease. As William Gibson pointed out in his excellent article entitled "The cost of *not* doing medical research," "If you think medical research is expensive, try disease" (4).

Despite this, we are frequently challenged with the statement, "But is biomedical research cost effective? After all, we spend literally billions of dollars on biomedical research. Do we really get our money's worth? If we put more into this effort, could you *guarantee* greater results?"

The answer to this question in my opinion is an unequivocal and resounding "Yes." Of course, sometimes experiments do fail, such as the recent launching of a Trident II missile which cost 24 million dollars and lasted only 4 seconds (5). However, when it comes to medical research, the public not only gets its money's worth, it gets a bargain.

Defense	13.2 %
Pharmaceutical	6.7 %
Leisure Time	5.1 %
Aerospace	4.6 %
Electronics	4.1 %
Automotive	3.5 %
Tire & Rubber	2.3 %
Health	2.9 - 3.1 %

Figure 2. R & D expenditures in various industries (as % of total). The figures for defense and health were calculated from data in references 1, 2, and 8; the remaining data were taken from reference 3.

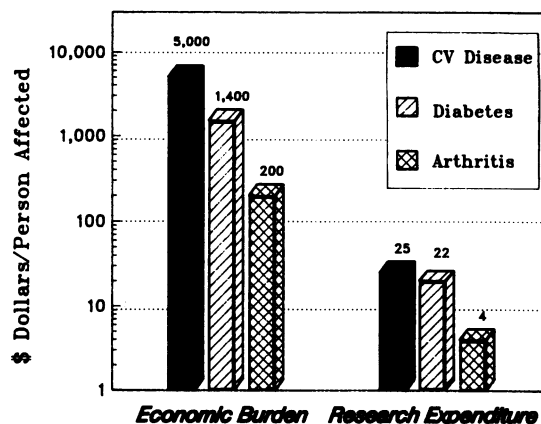


Figure 3. Economic burden of disease versus research expenditures. These data were compiled using the NIH Data Book (1), the Special Supplement on The Killing Diseases in *Sacramento Bee* (7), and data provided by The American Heart Association, American Diabetes Association, Juvenile Diabetes Foundation, and the Arthritis Foundation.

One need only open the newspaper to realize what others realize: we are curbing disease and we are living longer. If one considers the period of 1950 to the present, the average length of life for individuals living in the U.S. has increased steadily at an average rate of 10.2 weeks per year, and there is no evidence of a plateau in sight (6). Thus, for every year an individual lives, there is an increase in life expectancy of 10 weeks, or to put this in business terms, a 20% return on investment.

There is ample tangible evidence for the cost effectiveness of biomedical research. The best example of recent history, of course, is the effective vaccination for poliomyelitis. It has been estimated that in the first six years after the polio vaccine became available, over 150,000 cases of paralytic polio and 12,500 deaths were prevented. The prevention of these paralytic cases averted the loss of 6.3 billion dollars of income and saved hospital costs of approximately 2 billion dollars per year (4), not to mention the other medical care costs and human suffering. To put this in modern terms, if an effective vaccine for polio had not been discovered, the cost of this disease in 1989 would be over 30 billion dollars annually, or over four times the entire NIH budget for biomedical research.<sup>2</sup> Thus, this one discovery alone has offset the cost of all biomedical research past, present, and future.

There are many other points which could be used to show that biomedical research is indeed cost effective. In addition to the steady increase in longevity and the use of vaccines for prevention of most viral childhood illnesses, there is now effective treatment for most bacterial and fungal infections. While it is hard for us to realize, effective treatment of diseases such as tuberculosis again saves literally billions of dollars in health care costs per year (4). Turning to more recent times, many of us have recognized a dramatic reduction in deaths due to stroke by elucidation of mechanisms of hypertension

2. Current cost of polio was calculated based on data in reference 3, adjusted for inflation in medical costs using figures from "Can You Afford to Get Sick?", *Newsweek*, January 30, 1989 (about sevenfold increased over the past 30 years), and assuming a threefold increase in income potential over this period.

and the development of antihypertensive drugs (1, 7). We now have sophisticated diagnostic imaging that results in the early diagnosis of many diseases. We have an understanding of the treatment of arrhythmias and lipid disorders, resulting in reduced cardiovascular death (1, 7). Only 10 years ago the first proteins were produced by recombinant DNA expression in bacteria. Now we accept as expected and commonplace recombinant DNA production of proteins for human therapy, including for hormones such as insulin and growth hormone, growth factors, and tissue plasminogen activator. We accept as routine the control of gastric acid secretion in the medical treatment of peptic ulcer disease, the treatment of end-stage renal disease with dialysis and transplantation, the transplantation of other organs, and the effective therapy of many types of lymphoma and some other cancers resulting in true cures.

So if biomedical research is both underfunded and cost effective, why isn't there more? It is obvious that the causes of this problem are multifactorial. One need not think very long nor hard to come up with a list of many contributing factors: the high level of competition for funds from federal sources; the needs in many other important areas of public funding such as housing, food, and health care; and the political pressures to fund other activities, such as defense. Most of these are problems that neither you nor I can satisfactorily address, certainly not in this forum, nor in any 20-minute discussion. But there is one contributing factor that we can control, and that is our own behavior.

For in the area of research funding, I believe that "We have met the enemy and they are us."<sup>3</sup> But wait, you say, we do make our effort to improve the system. We all spend considerable time in various activities involved in obtaining grants and trying to prioritize research spending. We have peer review.

The peer review system certainly was established with the best intent of researchers to use wisely the funds provided. Most of us have both contributed grants to the system and served in some capacity in the system of review. But is this the solution to any of the problems we have discussed? When I think of peer review, I am reminded of the story of the two business executives who went on a camping trip. The next morning, they were startled by a large bear that broke into their camp. They were about to run when one of them said "Wait! Stop! I need to put on my tennis shoes." The other turned to his friend and said "Why bother to put on your tennis shoes? They won't help you to outrun the bear." The first replied, "I don't have to outrun the bear. I just have to outrun you."

Prioritizing biomedical research does not solve the problem. No matter how well intentioned, how carefully performed, how cleverly devised the system, our attempts to arrange priorities will be, and are, stifled by a system that has inadequate resources. Although we may not wish to emulate it, let me remind you that the large defense research budget is almost entirely non-peer reviewed. In fact, the defense research budget contains over 22 billion dollars worth of programs that are "black labeled," meaning the public is never even apprised of the title of the research, much less its content (8). By contrast, as we try to establish priorities for various research projects, we give nonscientists the impression that since we have funded the highest ranking grants, there is no

loss to society by not funding the others. But we should remember that our ranking does not take into account the rest of societal priorities, most of which are not so critically considered. As a result, when viewed in this context, we have helped create a series of what might be viewed as "perverted priorities." Let me give you an example of what I believe to be some of these perverted priorities.

Americans spend over 1 billion dollars a year on popcorn, over 700 million dollars on peanuts, and only about 500 million dollars for research in heart disease (1, 8, 9). Thus, when someone says that budget for heart research isn't even peanuts, it's not a joke.

If you think the defense budget is big, it's nothing when compared with many other budgets. For example, advertising budgets. Did you know that cigarette companies spend between 0.7 and 1.4 billion dollars a year on advertising, or between two and four times the NIH budget for all research into pulmonary diseases (1, 9)?

Another good example is Nintendo. This toy sells for \$100. This year Americans spent 1.7 billion dollars on Nintendo; by contrast, the government spent only 1.5 billion dollars on all of cancer research (1, 10).

And what about baseball, our favorite pastime? In 1985 *Sports Illustrated* listed 40 baseball players making over a million dollars a year, and the list has now grown to over 100 players. As Bill James points out in his book *Baseball Abstracts*, "One of the unwritten laws of economics is that it is truly impossible to prevent the values of society from manifesting themselves in dollars and cents. This is ultimately the reason why we pay athletes so much money. . . . He goes on to say, "The standard example is cancer research. Letters pop up all of the time saying that it is absurd for baseball players to make 20 times as much money as cancer researchers. But the hard, unavoidable fact is that we are, as a nation, far more interested in having good baseball teams, than we are in finding a cure for cancer" (11).

And there are many more subtle but equally devastating perverted priorities, to some of which we contribute. For example, when the effort and concern of scientists and the public over fraud and misconduct in science exceed the attention to scientific process and advances. We are all aware of the fact that recently distinguished researchers have been publicly criticized by other scientists for possible scientific misconduct. This, in turn, has led to attention by some members of congress and the media to possible fraud in research. While none of us condones fraud or scientific misconduct, these are truly rare occurrences, and, as most of us realize, usually have no significant impact on scientific progress, since research tends to be self-correcting whether errors occur accidentally or knowingly. Yet we find many scientists who seem to be caught up in this frenzy, undermining public confidence, diverting us from our true goals, and forcing us to spend more time addressing these issues rather than the more important issue of research progress and research funding.

So with this as a backdrop you might ask, "Well, what can we do? Isn't this a problem that we can't overcome?" I don't think so. I think that we are smart enough, talented enough, and in a position to affect the future of biomedical research. But to do so we must change the way we approach the problem.

First, we must think big. I mean really big. We have spent too much time thinking that budgets of hundreds of thousands

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3. Adapted from Pogo, Walter Kelley (1923-1973).

of dollars or even millions of dollars are sufficient to accomplish the important goals that we have before us. Here is a little exercise to help you begin this process.

Fig. 4 lists the annual sales of the five top industrial corporations. Note that even the smallest of them is almost 10 times larger than the entire NIH budget.

If you think that's big, think bigger. Organized crime, gambling, drugs, prostitution, and racketeering represent an over 200 billion dollar a year business (8). This is twice as large as the largest legal corporation and 15 times more than all medical R & D.

And if you think that is big, you can think bigger yet. On October 17, 1987, the stock market lost 500 billion dollars in value in one day (8). That is more than twice the NIH budget for all of the years of its existence since it was founded over 100 years ago.

So when someone asks you how much biomedical research is enough, the answer should be clear. At the very least we should be on par with other major technology-based industries; that is, at least 6–7% of all health expenditures should be for R & D. Since the current health care budget is 544 billion dollars, 6.5% would be approximately 35 billion dollars, or somewhat more than twice the current total spending for biomedical research from all sources combined.

But who then should pay for biomedical research? To me the answer to this question is also obvious. Every industry or person who benefits from biomedical research should pay part of the bill. Of course the first installment, the major installment, needs to come from the federal government.

While the NIH budget has risen steadily when expressed in current dollars, in constant dollars (that is, when corrected for inflation) there has been absolutely no growth in the NIH budget over the past eight years (1, 2). So the first order of business is to begin a fight for a major, significant increase in the NIH budget for research. Let me present a proposal. The total NIH budget for 1989 is about 7.1 billion dollars. This amounts to only \$28 per person per year or 8 cents per person per day. If at minimum we could increase the per capita contribution by 5 cents per day, there would be \$4.5 billion more for research. There is even a ready-made slogan for this campaign. How about "A nickel a day keeps the doctor away." Of course, a dime would be even better.

Second, we must find ways to tap industrial funding for biomedical research more effectively. Over the last eight years pharmaceutical funding for research has risen at a much faster rate than the NIH funding, such that the pharmaceutical industry has now actually surpassed the NIH in the amount of money spent on research (1). Of course, we must approach industrial funding carefully and appropriately, and must be on

guard against conflicts of interest or becoming involved in research that might not be viewed as academically appropriate or academically challenging. In my opinion, however, these issues should not cloud the fact that academic research will, and probably should, receive more funding from the pharmaceutical and biotechnology industries in the future if we are to realize our maximal productivity.

I have not yet mentioned nonprofit foundations, but certainly they continue to be a rapidly growing source of biomedical research support, although they still represent a small fraction (about 8%) of the total. This is a very important component of the total picture, however, since these agencies often provide funding for young investigators and new pilot and feasibility projects. Thus, we should support such agencies to whatever extent possible to both increase the funds they raise and use them effectively for research.

Finally, I believe it is our job, not someone else's, to search for new sources of research support. Two sources I believe could and should be recruited for the cause are the two industries that most directly benefit from our product; namely, the funders of health care and the life insurance industry (12). Private health insurance, including Blue Cross/Blue Shield and various HMOs, represents an approximately 220 billion dollar business (8, 13). Clearly, we are the R & D for this component of the health care industry, as well as for patients on medicare and medicaid, yet only the federal government supports research. Likewise, the life insurance industry collects over 130 billion dollars in premiums annually (8, 12). And as individuals live longer, life insurance companies benefit from this longevity by increased time during which they can have these funds earning interest in other investments. If we could convince these two industries that they should contribute at least 1% of their sales to R & D (and they certainly should do that at minimum), this would generate more than 3.5 billion dollars for biomedical research.

Another novel approach might be a biomedical research credit card. The Juvenile Diabetes Foundation, for example, sponsors a Visa card under its own logo. For this sponsorship they are entitled to one percent of the gross sales charged on this card. Since over 100 billion dollars is charged each year on all credit cards (8), if there were a National Medical Research credit card in use by 10% of the population, one could raise over 100 million dollars for medical research with virtually no effort.

Of course these represent only a few possible new ideas. There are other approaches that could be considered: other types of industrial relationships that might be appropriate, other types of public relationships, and other bright ideas that I am sure we and others could develop given time.

We are about to enter the final decade of the 20th century. There is no doubt that we are poised in a position never before experienced in medical research. Within our grasp are the tools and the technologies to unravel many of the important medical problems facing humankind. We have the ability and the talent. What we need are the appropriate resources and time to apply them. While these may not be as easy for us to grasp as the science itself, we must take a larger role in determining our own destiny.

The old triple threat, the physician, the scientist, and the teacher, must be remolded into the new triple threat, the physician/scientist, the politician, and the salesman. Everyone from the directors of NIH to the heads of departments, profes-

#### **Top Five Industrial Corporations**

General Motors	\$ 102 Billion
Exxon	\$ 84.1 Billion
Ford Motor Co.	\$ 71.6 Billion
Mobil	\$ 56.4 Billion
IBM	\$ 54.2 Billion

#### **Organized Crime**

Over \$ 200 Billion

#### **Stock Market Loss of Oct. 17, 1987**

\$ 500 Billion

Figure 4. An exercise in "Thinking Big." From data in reference 8.

sors, associate professors, assistant professors, and even research fellows, must take a more active role in solving this problem. Likewise, our societies, including the ASCI, APCR, and AAP, can no longer serve as ivory towers or take a stand-off approach to dealing with the public, but must present determined, businesslike, and perhaps even hard-sell approaches to research support. If we spent 25%, or better yet, 50% as much time thinking about and searching for new sources of funding as we did trying to prioritize and review the existing sources, we would find many new avenues to explore. We have the ability, but we must exercise it. We must not search for further excuses, but must each take our role in supporting the research industry as seriously as we take our roles in doing the research.

I believe there are few things in life that have a more noble history and a greater potential for improving the future of mankind than biomedical research. We should be proud to be members of this profession and continue to train and influence many others to join our ranks. We must build on the past and present to realize the future potential as we move into the 21st century. We must create a stable and thriving research industry. We must be the spokesmen—no, the salesmen—to educate and communicate to society the value of biomedical research, so that the public will want, and even demand, more of this most precious commodity.

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